

**ALASKA FEDERAL OFFSHORE**  
**Descriptions of Geologic Plays**  
*1995 National Resource Assessment*  
U.S. Minerals Management Service

**GULF OF ALASKA ASSESSMENT PROVINCE**  
*(John Larson and Gary Martin)*

The Gulf of Alaska assessment province is divided into six geologic plays that reflect the tectonic and stratigraphic histories of the diverse tectonic terranes that underlie the Gulf of Alaska shelf. These plays are: (1) the Middleton fold and thrust belt; (2) the Yakataga fold and thrust belt; (3) the Yakutat shelf - base of Yakataga Formation; (4) the Yakutat shelf - Kulthieth Formation; (5) the Southeast Alaska shelf subbasin; and (6) the Subducting terrane. All of the known potential source rocks and reservoir rocks in these plays are Tertiary in age.

**Play 1 (UAGA0101<sup>1</sup>). Middleton Fold and Thrust Belt Play :** This play encompasses the offshore area extending west from the Kayak zone to approximately 149 degrees W. longitude. Traps are primarily asymmetric anticlinal closures formed on the upthrown sides of high-angle thrust or reverse faults during the late Neogene to Pleistocene. Reservoir objectives consist of sandstones in the lower part of the glaciomarine, late Miocene to Pleistocene Yakataga Formation, and sandstones locally developed in the underlying Oligocene to early Miocene Sitkinak Formation. Potential source rocks are the Sitkinak Formation (marginally mature to thermally immature) and the thermally mature Eocene Sitkalidak Formation. Both formations consist of deltaic to nonmarine sequences characterized by poor to marginal organic richness and gas-prone kerogen. The Tenneco Middleton Island State No. 1 well tested a structure in this play without recovering producible hydrocarbons.

**Play 2 (UAGA0201). Yakataga Fold and Thrust Belt Play :** This play extends from the Kayak zone eastward to the Pamplona zone. Potential traps are primarily areally extensive, fault-bounded anticlinal structures of Pliocene and younger age, with some stratigraphic traps possibly formed adjacent to the structures. The most prospective reservoir objectives within drillable depths are sandstones of the lower Yakataga Formation, up-dip sandstone pinchouts within the Yakataga Formation, and locally developed sandstones in the

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<sup>1</sup>The "UA" Code is the "Unique Assessment Identifier" for each play, and is the principal guide to GRASP data files.

upper part of the underlying Poul Creek Formation siltstone sequence. Two potential source rock systems are known: 1, Eocene rocks of the nonmarine to deltaic Kulthieth Formation and its deeper marine equivalent facies; and 2, middle to upper Miocene rocks of the upper Poul Creek Formation. Oil has been generated at several onshore locations, including oil produced at Katalla from 1901 to 1932. However, the organically richest Miocene interval is mainly thermally immature offshore, and the Eocene source rocks are mature there only when deeply buried. Ten exploratory wells have tested several of the larger structures in this play and failed to discover recoverable hydrocarbons.

**Play 3 (UAGA0401). Yakutat Shelf - Basal Yakataga Formation Play :** This play encompasses the area from the Pamplona zone southeastward to just west of Cross Sound. There are a few large structural highs mapped in the area, but traps are mainly inferred to be stratigraphic and structural/stratigraphic in nature. These traps contain reservoir sandstones of the basal Yakataga and uppermost Poul Creek Formations, and consist of up-dip pinchouts, basement onlap, lateral facies transitions, and up-dip truncations against normal faults. The source rocks are the same as in the Yakataga fold and thrust belt play. Source intervals are deeply buried with moderate to relatively high thermal maturity in the northwest and are shallower with decreasing maturity to the south and east. The ARCO OCS Y-0211 (Yakutat No. 1) well tested the largest mapped structure in the play area, and recorded minor oil shows.

**Play 4 (UAGA0501). Yakutat Shelf - Kulthieth Sands Play :** This play underlies play 3 (Yakutat shelf - Basal Yakataga Formation) and is confined to the Eocene Kulthieth Formation. It has the same northwestern limit as the overlying play, but does not extend as far southeast. Trapping mechanisms are similar to those of the overlying play, but with additional potential for unconformity and stratigraphic traps along the southeast margin and for fault traps in the southeastern corner of the area. Potential source rocks consist of somewhat gas-prone shallow marine deltaic to basinal marine sediments in the lower part of the Kulthieth Formation and its equivalents. Relatively thick reservoir sands occur higher in the Kulthieth Formation. The ARCO OCS Y-0211 (Yakutat No. 1) well encountered minor oil and gas shows in the Kulthieth sandstones.

**Play 5 (Not Quantified). Southeast Alaska Shelf Subbasin Play :** Most of the southeast Alaska shelf is not prospective for hydrocarbons because total sedimentary thicknesses there are generally less than 2,000 feet, too thin for effective hydrocarbon accumulation. The southeast Alaska shelf subbasin is an exception to this, consisting of a structurally isolated, fault-related subbasin about 35 miles wide and 65 miles long. It lies west of Prince of Wales Island and contains up to 20,000 feet of probable Cenozoic sediments that overlie metamorphic and low-grade metamorphic Mesozoic and Paleozoic basement rocks. Thermal maturity for hydrocarbon generation is possible in the central portion of the subbasin at depths below 13,500 feet.

Equivalent sedimentary rocks are lacking onshore in the immediate area. The nearest

## OIL AND GAS ENDOWMENTS OF GULF OF ALASKA SHELF PLAYS

*Risked, Undiscovered, Conventionally Recoverable Oil and Gas*

PLAY NO.	PLAY NAME (UAI * CODE)	OIL (BBO)			GAS (TCFG)		
		F95	MEAN	F05	F95	MEAN	F05
1.	Middleton Fold and Thrust Belt (UGA0101)	0.000	0.013	0.074	0.000	0.456	2.700
2.	Yakataga Fold and Thrust Belt (UGA0201)	0.000	0.122	0.415	0.000	0.805	2.677
3.	Yakutat Shelf-Basal Yakataga Fm. (UGA0401)	0.000	0.111	0.313	0.000	0.669	1.937
4.	Yakutat Shelf-Kulthieth Sands (UGA0501)	0.000	0.308	0.778	0.000	1.967	5.397
5.	Southeast Alaska Shelf Subbasin	Not Quantified Owing to Assessed High Risk					
6.	Subducting Terrane (UGA0701)	0.000	0.076	0.222	0.000	0.282	0.926
	<b>FASPAG AGGREGATION</b>	<b>0.183</b>	<b>0.630</b>	<b>1.434</b>	<b>0.937</b>	<b>4.180</b>	<b>10.589</b>

\* Unique Assessment Identifier, code unique to play.

sedimentary rocks that are probably equivalent to the southeast Alaska shelf subbasin strata are in the Neogene age Skonun Formation. These rocks occur on Queen Charlotte Island and in the offshore Queen Charlotte basin, over 150 miles to the southeast in southwestern British Columbia. Skonun strata have favorable potential for reservoir rocks in the southern part of the Queen Charlotte basin, where they overlie potential source rocks of Mesozoic age. However, 14 exploratory wells have been drilled there with no producible hydrocarbon discoveries. In addition, Skonun lithofacies become increasingly nonmarine and gas-prone to the north and west in the direction of the southeast Alaska shelf subbasin, indicating poor source rock potential for the subbasin play. The overall likelihood of hydrocarbon accumulations in the southeast Alaska shelf subbasin is presently judged to be too low to justify further evaluation.

**Play 6 (UGA0701). Subducting Terrane Play :** This play is located in the offshore area surrounding Kayak Island. In this area, Eocene to Miocene sedimentary rocks of the lower part of the Tertiary section on the Yakutat terrane are apparently being subducted along the Kayak zone, where underthrusting proceeds to the north and west beneath the basement rocks, i.e., the deformed Orca Group metasediments. Oil and gas in seeps that occur along the onshore extension of the Kayak zone at Katalla are thought to originate at depth in the area, generated from subducted Poul Creek and Kultheith Formation source rocks and then migrated upward along fractures and fault surfaces.

Traps in this play are likely to consist of extensively folded and faulted structures similar

to those exposed onshore. Hydrocarbon accumulations might also occur in up-dip stratigraphic/structural traps along the southeast margin of the play. Potential reservoir rocks are Kulthieth and Yakataga Formation sandstones. Fracture-porosity reservoirs can also be inferred because oil was produced from fractured shales and siltstones of the Poul Creek Formation in the abandoned Katalla field onshore.

The information in this section is largely developed and/or adapted from material presented in Risely and others (1992).

## **REFERENCES CITED**

Risley, D.E., Martin, G.C., Larson, J.A., Lynch, M.B., Flett, T.F., and Horowitz, W.L., 1992: Geologic report for the Gulf of Alaska planning area, Turner, R.F., ed., U.S. Minerals Management Service OCS Report MMS 92-0065, 302 p., 130 figs., 9 appendices.